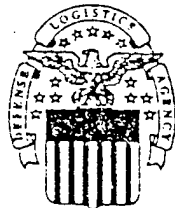CALS TEST NETWORK

CALS Test Network
Strategic Plan

October 11, 1989

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Lawrence Livermore National Laboratory

Preface

Testing, relating to any specification or standard, requires certain actions. CALS standards and specifications, as a subset of all standards, require the same actions in testing. The testing includes: a) Conformance Testing; and b) User Application Testing. The management of CALS conformance testing, as an overall tasking, has been assigned to the National Institute of Standards and Technology; user application and related testing, as an overall tasking, has been assigned to the CALS Test Network Office.

This Computer-aided Acquisition and Logistic Support (CALS) Test Network Strategic Plan primarily supports User Application Testing and is a document which will have periodic updates. These will occur as the technology of CALS Standards and testing grows and matures. New specifications may be required and existing specifications will be amended as needs for corrections and updates are identified.

This plan is the responsibility of the CALS Test Network Office, managed by the Air Force Logistics Command Logistics Management Systems Center, Technology Support Office. Any recommendations for change or comments about the content should be sent to:

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Executive Summary

The CALS Test Network (CTN) was created to thoroughly test, evaluate, and demonstrate the CALS Standards. It was set up under the direction of the Office of the Assistant Secretary of Defense (OASD), is managed by the CALS Test Network Office (CTNO) at the Air Force Logistics Command (AFLC), with an operational laboratory at the Lawrence Livermore National Laboratory (LLNL).

The overarching goal of the CTNO is to test, evaluate, and demonstrate the interchange and functional use of digital technical information between industry and government using CALS Standards. A part of this goal is to test, at the corporate Department of Defense (DoD) level, the usability of the CALS standards in the DoD infrastructure, and eliminate duplicate testing by the DoD components.

The CTNO objectives are:

1. Develop a CALS Test Network for user application testing of CALS Standards under actual use conditions.

    a. Assist in setting up Service Lead Test Beds.
    b. Identify industry and government participants.
    c. Identify appropriate logical and physical network linkages.
    d. Assist in establishing a CALS Standards Application Center of Excellence at each Service Lead Test Bed.

2. Operate the CTN and interchange digital technical data.

    a. Demonstrate the CALS Standards over current user applications.
    b. Evaluate the capabilities and effectiveness of the Standards.
    c. Identify needed improvements to the Standards.
    d. Identify requirements for new digital data standards.
    e. Create CALS Reference Test Sets
    f. Assist DoD users in the development of Data Acceptance Testing Procedures.
    g. Develop guidance on how to use the CALS Standards.
    h. Help define functional application specifications.

3. Implement a CTN Review Board (CTNRB) of government members.

   a. Review CTN test plans and establish priorities for CTN testing.
   b. Review CTN test results and propose corrective actions.
   c. Distribute CTN test reviews and corrective action status reports.

Some operational features of CTN follow:

1. CTN is a confederation of government and industry participants.
2. The CTN "logical" network will consist of existing as well as new facilities.
3. User application tests will normally go from one facility to another (end-to-end).
4. Test files will be one of two types, actual weapon system data or reference data of precisely known content.
5. Tests will be planned independently by the participants, or by the Service Lead Test Beds or CTNO technical staff.
6. Technical review of test plans will be performed by the CTNO. Test Plans will be approved by the CTNRB before being sent to the OSD CALS Planning Group.
7. Test reports will be made available to CTN members after coordination with the participating facilities.
8. Testing will begin with current CALS Standards and application categories, and will expand as CALS matures.
9. Each Service will have its own Service Lead Test Bed to serve as its CTN testing focal point.

CALS Test Network Strategic Plan

1 Goal, Objectives, and Overview

1.1 Introduction

This Strategic Plan (SP) details the creation of a logical network to thoroughly demonstrate, test, and evaluate the Computer-aided Acquisition and Logistic Support (CALS) Standards (see Appendix C). The network, known as the CALS Test Network, will be formed from existing and new components within industry and government. It will be operated under the direction of the CALS Test Network Office (CTNO) at the Air Force Logistics Command (AFLC) Logistics Management Systems Center, Technology Support Office (LMSC/SJT), for the Office of the Assistant Secretary of Defense (OASD) Production and Logistics Systems/CALS. Technical operation is provided by the Lawrence Livermore National (LLNL) Automated Interchange of Technical Information (AITI) Project.

The focus of the CALS Test Network will be the interchange of digital technical information, as defined by the Department of Defense (DoD) CALS Program. The CTN will be used to demonstrate and examine the effectiveness of the CALS Standards under actual use conditions and to check the functional use of the information that is transferred. Test capability provided by the CTN will also be useful for evaluating technologies, both current and future, that go beyond present Standards.

Within this Strategic Plan are descriptions of the CTNO overarching goal, objectives, tasks, resources, schedules, network, and participants. The Plan is organized in chapters. Chapter 1 contains the goal, objectives, and an operational overview of CTN. Chapter 2 details its operation. Chapter 3 deals with general testing concepts. Subsequent chapters contain plans and information that are specific to the CALS application categories; additional chapters will be added, one for each category, as the standards defining the categories and the related test procedures mature.

1.2 Overarching Goal of the CALS Test Network Office

The overarching goal of CTNO is to test, evaluate, and demonstrate the interchange and functional use of digital technical information between industry

and government using CALS Standards. A part of this goal is to test, at the corporate DoD level, the usability of the CALS standards in the DoD infrastructure, and eliminate duplicate testing by the DoD components.

1.3 Objectives

1.3.1 Develop a CALS Test Network for user application testing of CALS Standards under actual use conditions.

    a.   Assist in setting up Service Lead Test Beds (SLTBs) for evaluating and/or developing test software and for performing detailed analysis of digital data.

    b.   Identify industry (contractor or vendor) and government (DoD or other government agency) Test Participants among existing sites.

    c.   Identify appropriate network linkages which may be "physical" such as telecommunications links or "logical" such as magnetic tapes.

    d.   Assist in establishing a CALS Standards Application Center of Excellence at each Service Lead Test Bed.

1.3.2 Operate the CTN and interchange digital technical data to:

    a.   Demonstrate the technical capabilities, operational suitability, and functional use of the CALS Standards over the complete range of DoD and industry user applications.

    b.   Evaluate the capabilities and effectiveness of the CALS Standards.

    c.   Identify needed improvements to the Standards.

    d.   Identify requirements for new digital data standards.

    e.   Create Reference Test Sets for all application categories, with their various types and classes, covered by the CALS Standards.

    f.   Assist DoD users in the development of Data Acceptance Testing Procedures, then demonstrate its use on digital data delivered in fulfillment of contracts at DoD sites.

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g. Develop guidance (in the form of check lists, scenarios, scripts, and reports) on how to use the CALS Standards.

h. Help define functional application (application protocol) specifications needed to apply the CALS Standards to a particular user application and environment.

1.3.3 Implement a CTN Review Board (CTNRB) of government members.

a. Review CTN test plans and establish priorities for CTN testing.
b. Review CTN test results and propose appropriate corrective actions.
c. Distribute CTN test reviews and corrective action status reports to CTN Test Participants and the CALS community.

1.4 Operational Overview

1.4.1 The CTN is a confederation of government and industry agencies. Test Network Participants fall into three categories: Government Test Participants, Industry Test Participants, and Service Lead Test Beds (see Subsection 2.4.2).

1.4.2 The CTN "logical" network will consist of existing as well as new facilities. This will help keep implementation costs down (see Section 3.1).

1.4.3 CTN user application testing will focus on complete (end-to-end) transfers of actual weapon system data. This will help ensure actual use conditions and will utilize existing sites (see Subsection 3.2.1).

1.4.4 Test files will be one to two types, actual weapon system data or reference data of precisely known content (see Section 3.3).

1.4.5 There are two types of user application tests: (1) Independently Planned Tests (IPTs) - those planned and executed independent of formal CTNO funding and coordination by industry or government entities, and (2) CTN Planned Tests (CPTs) - those planned and executed by the Service Lead Test Beds or the CTNO with formal CTNO funding and coordination. Both types of test will be published by the CTNO and have summary test results loaded on the CTNO Information Exchange (Info-X) bulletin board. CPTs will have detailed analysis of the test data prepared by the Service Lead Test Bed or CTNO staff. For IPTs, CTNO will provide a checklist that can be used both to guide the digital transfer and to systematically record the results.

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1.4.6 Technical review of test plans will be performed by the CTNO. Test Plans will be approved by the CTNRB before being sent to the OSD CALS Planning Group. Service Lead Planners will be responsible for generating test plans from their respective components (see Subsections 2.3.1 and 2.3.3).

1.4.7 Preliminary test reports will be made available to CTN members on the CTN Information Exchange network shortly after each test, and after coordination with the participating facilities (see Subsections 2.2.3 and 2.4.3).

1.4.8 Testing will begin in the application categories of Technical Publications and Engineering Data, utilizing MIL-STD-1840A, MIL-D-28000, MIL-M-28001, MIL-R-28002, and MIL-D-28003. Expansion to the other application categories will occur as CALS Standards mature (see Subsection 2.1.2 and 2.2.1).

1.4.9 Each Service will have its own Service Lead Test Bed to serve as its CTN testing focal point (see Subsection 2.4.2).

1.5 Functional Relationships within CTN

1.5.1 The functional relationship of the CTNO with its constituent test participants is shown in Figure 1. Referring to the upper left-hand portion of the figure, the downward path shows the testing associated with a repository; the path starting to the right shows the test bed functions.

Industry/Developer Builds Data
- - -
Creates 1840A Tape
- - -
Sends Copy to CTN &
Service Data Bank

CTN Checks & Validates
1840A Envelope &
Relevant Specification
(28000, 28001, 28002, 28003)
- - -
CTN Gives Feedback
To Developer

CTN Prepares
Standard
Validation
Report
- - -
Lead Service Org
Modifies Standard
As Required
- - -
CTN Publishes
Validation Test
Report

Consolidated
Report

ARMY CALS Test Bed

DLA CALS Test Bed

Industry CALS Test Bed

DOE CALS Test Bed

Air Force CALS Test Bed

NAVY CALS Test Bed

CTN Core

User
Receives Data
- - -
CTN Helps
Validate Data
- - -
CTN & User
Develop Procedure
For Receiving Data
- - -
CTN Gives Feedback
To Developer &
Standards Groups

CTN & User (Army, Air Force,
Navy, DLA) Prepare Procedure
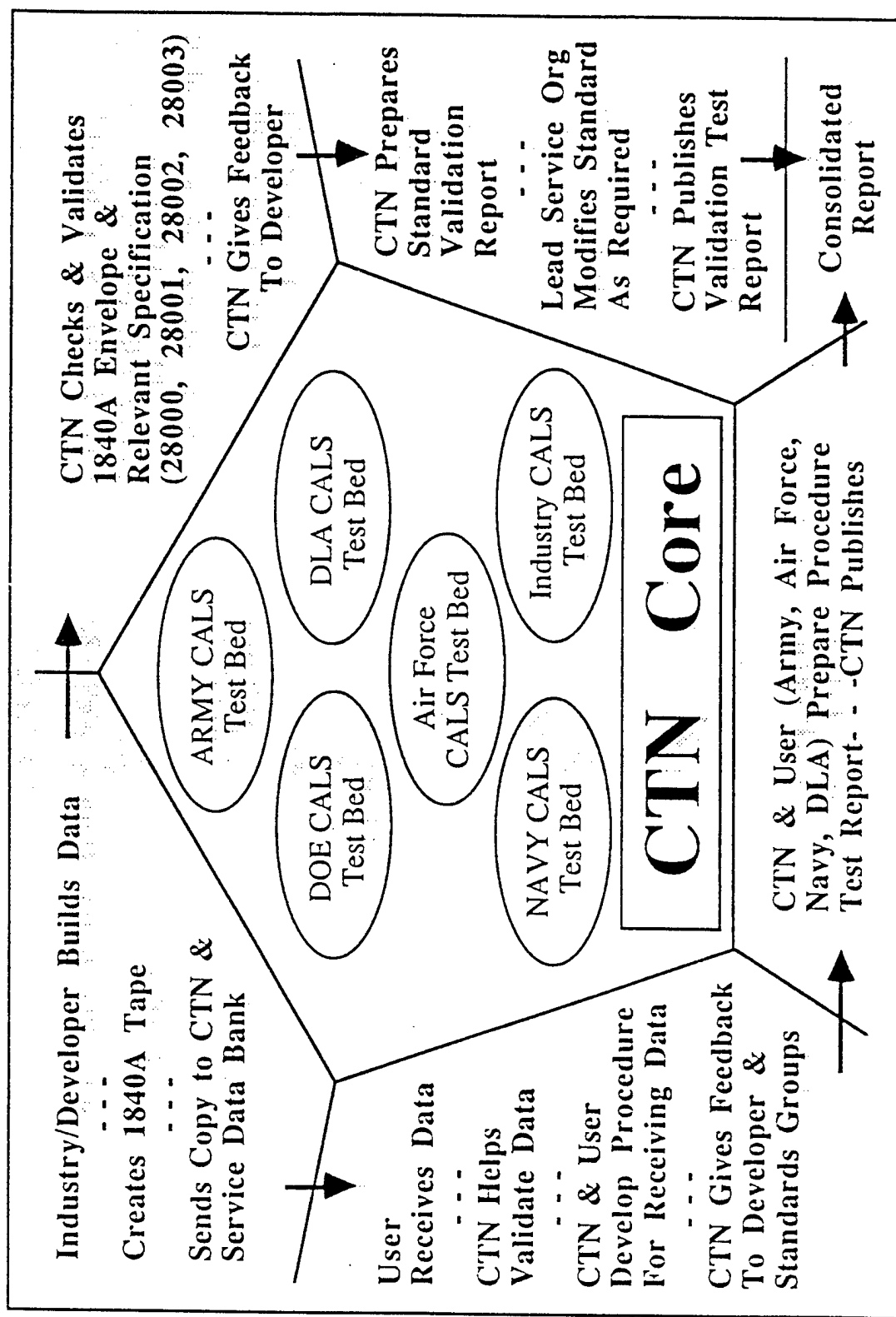Test Report- - -CTN Publishes

CALS Test Network Functional Relationships

Figure 1

2 CTN Operational Details

This chapter contains details about what Standards CTN is testing, how CTN is organized, how it functions, and how it interfaces with its test participants. It also contains a section on how CTN is affected by future directions in CALS.

2.1 Technical Structure of CALS Testing

2.1.1 Application Categories and Other Areas of Testing

CALS Standards eventually will apply to the broad application categories described below. Coverage of these application categories by current CALS Standards is indicated in Figure 2. Initial CTN activities are focused on testing transfers in the first four categories: Technical Publications, Engineering Data, Support Data, and Data Acceptance Procedures development and testing. The CTNO will monitor progress in the development and testing of the standards in the category of: Data Protection and Security. During FY-90 the CTNO will begin addressing Data Configuration Management and Small Business Capabilities.

2.1.1.1 Technical Publications

Technical Publications are textual documents that may also contain, illustrations, images, and tables. Examples of Technical Publications (Tech Pubs) are technical manuals and technical orders. See Chapter 4 for details on the testing of Tech Pubs transfers.

2.1.1.2 Engineering Data

Engineering Data is currently defined as technical information relating to parts, assemblies, and subsystems used to describe a weapon system. The information may pertain to design, analysis, manufacture, test, inspection, procurement, and reprocurement. Examples of Engineering Data are: (1) hard copy engineering drawings and (2) digital (raster or vector) data containing 2D drawings, 2D views, and 3D models with associated entities such as notes or tolerances. See Chapter 5 for details on the testing of Engineering Data transfers.

2.1.1.3   Support Data

Support Data includes on-line logistic support analysis data. As part of CALS Phase II, Support Data and Engineering Data are to be combined into an Integrated Weapon System Data Base (IWSDB).

2.1.1.4   Data Acceptance Procedures

Data Acceptance Procedures are being initially tested using the Army/Air Force DSREDS/EDCARS systems and will be expanded to include all technical data across all components of the DoD.

2.1.1.5   Data Protection and Security

Data Protection and Security will be addressed in the future. It will include encryption/decryption techniques, tempest, and security procedures used to protect proprietary and sensitive information from unauthorized access and disclosure.

2.1.1.6   Data Configuration Management

As the Services ramp up their use of digital technical data, a growing need for data configuration management, becomes crucial. Under this general heading comes Data Configuration Management itself, Indexing, and Data Dictionary. During FY-90, the CTN will begin to address these areas of testing as additions to the four areas currently underway.

a.   Data Configuration Management addresses the problems of data update, interoperability of data in data bases, syncronicity of data, control of update, version control, and other related topics. For the CALS concept to work in the CALS Phase II and beyond environment, all of these issues must be resolved and tested.

b.   Indexing addresses the query capability of a system and is pivotal to location of elements of data in a family of data bases. Consistent indexing principles must be developed and tested which operate across the multitude of heterogeneous systems present in the DoD.

c. The Data Dictionary standard controls consistent naming conventions across multiple data bases of technical data. Use of this concept reduces the misnaming of data elements and subsequent loss of data. Testing of a standard data dictionary is critical to the CALS concepts.

2.1.1.7 Small Business Capability

As the CALS concept pushes to the small business tier of suppliers of standard CALS data, testing of the interaction between these firms and the small systems being used is critical to the continuing enablement of CALS. Testing programs will be planned in FY-90 to demonstrate further the transparency of the standards across the small platforms typically used by small businesses.

CALS Application Categories	MIL-STD 1840A	MIL-D 28000 IGES	MIL-M 28001 SGML	MIL-R 28002 Raster	MIL-D 28003 CGM	MIL-STD 1388-2B (draft)
Technical Publications	√	√	√	√	√	
Engineering Data	√	√		√		
Support Data						√
Data Acceptance Procedures						
Data Protection and Security						
Data Configuration Management						

Figure 2

2.1.2 CALS Standards and Specifications

CALS Standards implement existing and emerging national and international standards. However, efficient implementation by DoD and industry of CALS-related technologies requires more than simply adopting an industry standard. CALS must agree on an explicit, unambiguous implementation of the Standard by choosing a set of options and user conventions (known as subsets, profiles, protocols, etc.) that meet the technical requirements of DoD and the defense industry in the most efficient manner possible.

CALS Phase I focuses on standards for digital interchange of technical information among dissimilar computer systems. CALS Phase II focuses on the standards needed to access and manage data within a distributed database. As CALS is implemented throughout DoD and the defense industry, both types of standards will be needed to provide interoperability among design, manufacturing, and support functions.

The initial increments of CALS Standards were developed and coordinated during 1987 (Phase I.0) and 1988 (Phase I.1). MIL-STD 1840A, "Automated Interchange of Technical Information," is the parent document for a family of military specifications through which the CALS standards will be published. It provides the rules for organizing files of digital data into a complete file set -- for example, a technical manual composed of MIL-M-28001 tagged text, MIL-D-28003 vector graphics, and MIL-R-28002 raster graphics.

Currently, MIL-STD-1840A (1840A) references the following four military specifications (see Appendix C for detailed descriptions):

a.   MIL-D-28000, "Digital Representation for Communication of Product Data: IGES Application Subsets."

b.   MIL-M-28001, "Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text."

c.   MIL-R-28002, "Requirements for Raster Graphics Representation in Binary Format."

d.   MIL-D-28003, "Digital Representation for Communication of Illustration Data: CGM Application Profile."

Also within the CALS family is MIL-HDBK-59, "CALS Program Implementation Guide." This is a military handbook that provides information and guidance to personnel responsible for the acquisition and use of weapon system technical data. Its purpose is to assist in the transition from paper-intensive processes to digital data delivery and access. It also supports the structuring of contract requirements to achieve integration of various contractor automated capabilities for design, manufacturing, and logistic support.

Another CALS standard is MIL-STD-1388-2B, "DoD Requirements for a Logistics Support Analysis Record." The goal of this standard, currently in draft form, is to establish standard requirements, data element definitions, data field lengths, and data relational table requirements for Logistic Support Analysis Record (LSAR) data.

2.2 Organization of CTN

This section details the background, organizational structure, and reviewing process that will be implemented to help CTN meet its goal and objectives.

2.2.1 Background

The CTN planning began during the first quarter of FY-88. CTN implementation began during the second quarter of FY-88. The Initial Operating Capability (IOC) was third quarter FY-88 with Full Operating Capability (FOC) expected in the fourth quarter of FY-89.

FOC for FY-89 will be in the application categories of Technical Publications and Engineering Data. Future CTN efforts will deal with the forthcoming application areas of Support Data, Data Protection and Security, and Data Configuration Management (see Subsections 2.1.1 and 2.1.2.). As the Standards mature and as new standards are developed, CTN will adjust its focus and schedule accordingly (see Section 2.5).

2.2.2 Organizational Structure

CTN will be directed and coordinated by the Office of the Assistant Secretary of Defense, with lead management responsibility assigned to the CALS Test Network Office, Air Force Logistics Command, Logistics Management Systems Center, Technology Support Office. The CTNO has assigned the technical operation of the CALS Test Network to the Lawrence Livermore National Laboratory under the Automated Interchange of Technical Information Project.

AFLC has appointed a CTNO Director and Assistant. A CTNO Operations Manager and Deputy have been selected at LLNL. A Lead Analyst has been appointed for each application category and for each specification within the CALS Standards. A Test Coordinator has been appointed to help review, coordinate, and process tests. See Appendix E for a listing of the lead CTNO technical staff members.

Service Lead Planners have been appointed by each of the Services. They are the Service CTNRB members and are responsible for development and coordination of their respective Service's CALS Testing. They have delegated authority to the respective SLTBs for test planning and execution.

Service Lead Test Beds have been established at each DoD Service. Each such test bed has been given lead responsibility for testing in an application category. See Subsection 2.4.2 for more details about Service Lead Test Beds.

2.2.3 Review Board

A CTN Review Board has been established to: (1) provide independent reviews of test plans and test results, (2) prioritize CTN testing, (3) propose and monitor corrective actions as appropriate, (4) distribute reports on CTN progress and Board reviews, and (5) coordinate CTN support for CALS development and implementation. CTNO will support the CTNRB in the review and distribution of test results.

a.   The CTNRB is chaired by the CTN Director (HQ AFLC LMSC/SJT). Members have been selected from the Department of the Army, Department of the Navy, Department of the Air Force, Lawrence Livermore National Laboratory, National Institute of Standards and Technology, Defense Quality and Standardization Office, and other invited government agencies. An advisory member from OSD CALS office has also been selected.

b.   A CTN Information Exchange has been developed and is being maintained by LLNL. It supports the CTNRB by providing a computer database connected to an electronic mail network for the collection and immediate distribution of CTN test results to CTN members. This database contains documentation on the results of both IPTs and CPTs as well the status of necessary corrective actions associated with those test results. Info-X data that has been reviewed and approved by the CTNRB or its Chairman will be available to the general public on the CALS Bulletin Board, maintained by the National Institute of Standards and Technology (NIST). Preliminary test reports will be made available on Info-X after coordination with the specific Test Participants. Instructions and passwords for accessing the CTN Info-X will be provided to CTN members upon joining the CTN.

2.3   CTN Operational Model

The CTN Operational Model, shown in Figure 3, describes the operations of the CTN and its component parts. The flow through the model, as depicted by the arrows, shows what would occur in a typical situation.

The model is designed to be executed by the CTNO, CTNRB, OSD Planning Group, Service Lead Planners and Service Lead Test Beds at the management level. The most significant time of execution is just prior to the beginning of the fiscal year. The overall plans for the year are laid out by the CTNRB at that time and the priorities for funding and action are set. At each of the next three quarterly meetings of the CTNRB, the priorities and decisions made at the beginning of the year are reviewed to see if changes should be made.

Each of the elements of the model or "bubbles", are described below. This description, in the whole, is the charter of the CTN, the CTNO, the Service Lead Planners, and Service Lead Test Beds.

2.3.1   User Priorities

During the fourth quarter meeting of the CTNRB, user priorities for testing in CALS capability areas and specific test requirements are set for the coming year. Each of the Service Lead Planners will survey their Service prior to the meeting and present that Service's priorities for testing. Each priority will be reflected in the form of proposed tests as designed by the Service Lead Planners.

The CTNRB will review these priorities for each Service and decide on the overall CTN priority set. The final priority will be decided by the CTNRB members and forwarded to the CTNO for inclusion in the Strategic Plan.

Also at this time, the CTNRB will review the SP and recommend updates to the CTNO. The CTNO has the responsibility to write the SP and revise it as required.
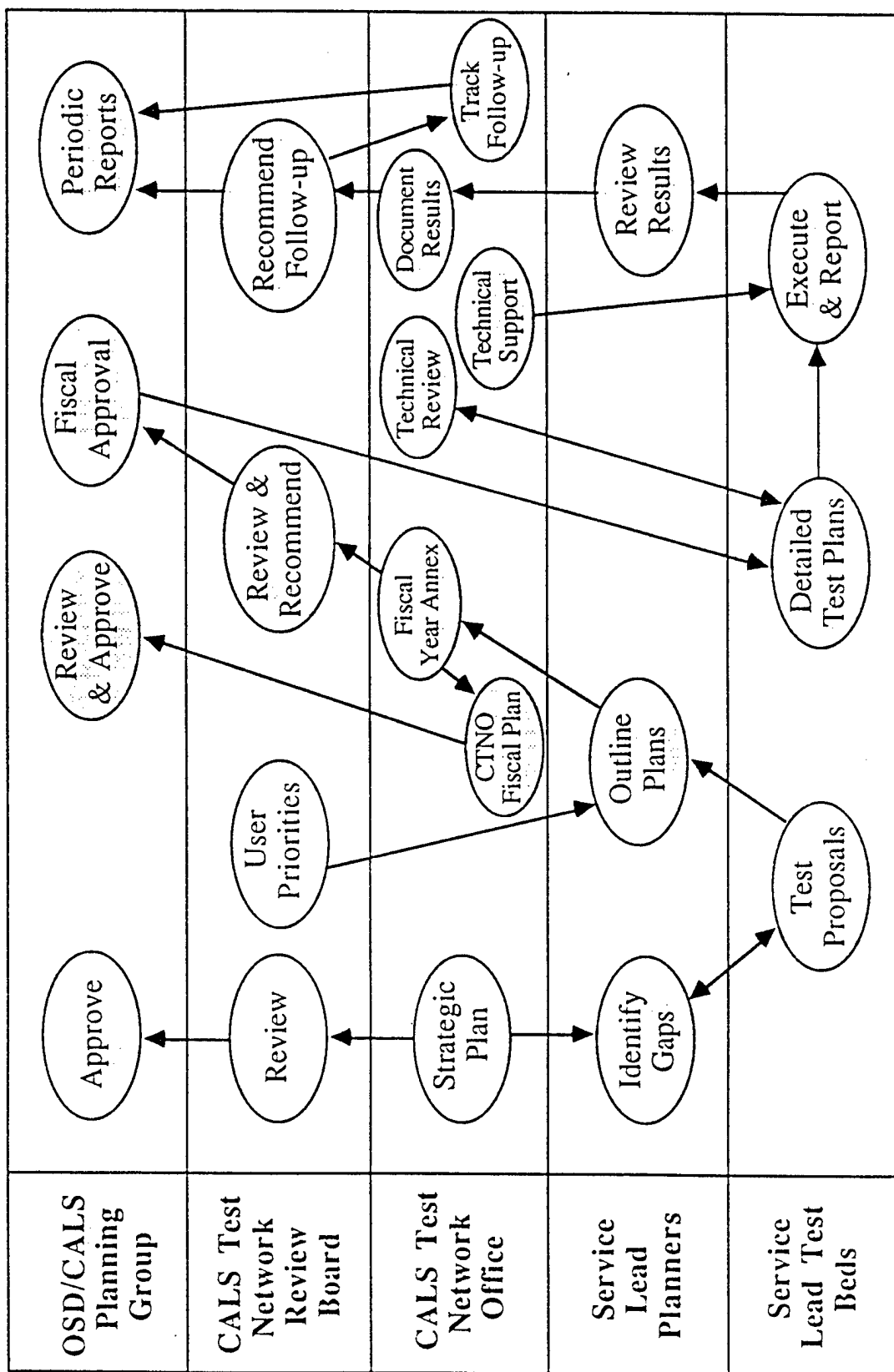
CALS Test Network Operational Model

OSD/CALS Planning Group	CALS Test Network Review Board	CALS Test Network Office	Service Lead Planners	Service Lead Test Beds

Nodes and flows (swimlane diagram):

- Periodic Reports, Fiscal Approval, Review & Approve, Approve (OSD/CALS Planning Group)
- Recommend Follow-up, Review & Recommend, User Priorities, Review (CALS Test Network Review Board)
- Track Follow-up, Document Results, Technical Review, Fiscal Year Annex, CTNO Fiscal Plan, Strategic Plan (CALS Test Network Office)
- Review Results, Technical Support, Outline Plans, Identify Gaps (Service Lead Planners)
- Execute & Report, Detailed Test Plans, Test Proposals (Service Lead Test Beds)

Figure 3

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2.3.2 Strategic Plan

Upon receipt of the User Priorities and proposed tests, the CTNO will prepare the Strategic Plan Fiscal Year Annex (SPFYA) for the upcoming year. The Strategic Plan sets forth the overall strategy for testing and demonstration of the CALS Standards, and in the SPFYA, sets the testing course for the year. The SPFYA will be reviewed quarterly by the CTNRB and updated as required.

In addition to the SPFYA, the CTNO is responsible for preparing the new fiscal year CTNO Financial Plan (FP). The FP will align to the CTNRB priorities and proposed tests.

Also at this time, the CTNO will review the recommended changes to the SP and any other changes which are needed due to policy changes, test results, or technology changes. If required, the SP will be republished along with the new SPFYA. After approval by the members of the CTNRB, the SP and SPFYA will be forwarded along with the CTNO FP to the OSD CALS Planning Group for approval.

The OSD CALS Planning Group will review and approve the SP, SPFYA, and the CTNO FP, and prepare a fiscal guidance letter which sets forth the directions in testing which have been approved for detailed planning and execution.

2.3.3 Priority Tests

Each of the priority areas and related proposed tests will have Outline Test Plans (OTPs) submitted by the Service Lead Planners. The test plans will address gaps in the testing of the standards or specific areas which need further testing due to changed circumstances. These outline test plans will also incorporate any other test proposals as forwarded by the Service Lead Test Beds.

Together, this package of OTPs which have followed the priorities set by the CTNRB and also followed the fiscal guidance provided by the OSD (Office of the Secretary of Defense) CALS Planning Group, will be forwarded to the CTNO for technical and administrative review.

2.3.4 Technical Review

The CTNO, upon receipt of the OTPs, will review for technical adequacy and provide suggested revisions to the Service that submitted each plan. These plans will be checked for duplication with other tests, suitability of the test to the standard, completeness of the test, adherence of the documentation to the CTNO documentation standards, completeness of the documentation, and adherence to fiscal guidance. These outline test plans will be forwarded to the CTNRB for review and approval. The CTNRB will forward the OTPs to the OSD CALS Planning Group for funding approval.

2.3.5 Funding Approval

The OSD CALS Planning Group will review the OTPs and authorize the CTNO to disburse funds to the Service Lead Test Beds for obligation of funds, detailed planning, and execution of the test plan.

2.3.6 Technical Support

The CTNO will also provide technical support to the Service Lead Test Beds during the test execution and test reporting phase. Examples of this support are supplying Reference Test Data Files, test procedures, technical advice, CTNO developed testing tools, specialized technical training, and on-site expert technical support.

Training and on-site support will be negotiated with the Service Lead Test Beds on a case-by-case basis, as required.

This technical support will be available during all phases of the CTN Operational Model. Requests for technical support should be sent to the CTNO Director (see Appendix E).

2.3.7 Test Results and Follow-up

The Service Lead Test Beds will execute the test plan and provide documentation of test results in the format specified by the CTNO. Included will be detailed documentation of any areas where the CALS Standards need revision.

These suggested revisions along with the test reports will be forwarded to the CTNO. The CTNO will document the revisions in a separate document and forward both the revisions report and the test report to the CTNRB for review and approval.

The CTNRB will review and approve the test report and CALS Standards revisions report. The revisions report will be forwarded to the appropriate standards group and a copy of the report forwarded to the OSD CALS Planning Group.

The CTNO will track the actions taken by the standards body to resolve the recommendations, and make periodic reports to the CTNRB quarterly or as required. The CTNRB will report these recommendations to the OSD CALS Planning Group. These periodic reports will summarize test results and standards revision recommendations. Included will be progress made by the standards groups in resolving the recommendations.

2.4 Interfacing with Industry and Government

2.4.1 Workshops, Conferences, and Demonstrations

The CTNO technical staff will conduct workshops covering the CALS Standards and testing of those Standards. The workshops will be held in conjunction with CALS meetings or other major conferences on CALS-related topics (such as NCGA and GCA), where possible, to minimize expenses.

The CTNO technical staff will participate in these conferences by conducting sessions and giving presentations that promote the CTNO objectives. These conferences provide: (1) large audiences to whom the CTNO staff can explain the function and value of the CALS Standards, and (2) a forum for sharing CTN test results and receiving comments on CTN plans. The CTNO staff will also organize and participate in demonstrations of transfers and Standards testing at conferences, where practical.

2.4.2 Test Network Participant Categories

The CTN is a confederation of government and industry agencies as described below. Members of this confederation may be CTN Test Participants, CTNRB members, CTNO technical and administrative staff, and other interested parties.

An organization or facility becomes a CTN Test Network Participant by filling out a CTN Membership Application and signing a Memorandum of Agreement (MOA). These documents describe the capabilities the participant will bring to the network and the method of interaction expected. To see about becoming a CTN Test Participant, contact a CTNO Lead Analyst, the CTNO Test Coordinator, the CTNO Director, or the CTNO Operations Manager. Contact information is found in Appendix E.

There are three types of Test Participants in CTN:

a. Government Test Participants - These include the Department of Defense, the Services within DoD, other government departments or agencies, and government research and development laboratories.

b. Industry Test Participants - These include defense contractors, subcontractors, and vendors of weapon systems or of weapon system related hardware, software, research, or data.

c. Service Lead Test Beds - In order to provide testing focal points for the major government components, each DoD Service will designate a Service Lead Test Bed. Such a test bed may be a single site or distributed sites. (See Appendix A for details on Service Lead Test Beds.)

As interchange testing proceeds, the Service Lead Test Beds will assume the day to day testing responsibilities such as: conducting tests, writing Test Reports, and consulting on questions about MIL-STD-1840A. The CTNO will continue to: (1) coordinate and monitor tests, (2) review and approve Final Test Reports, (3) participate in conferences, (4) interface with standards-making and reviewing organizations, (5) serve as the main contact for vendor participants, (6) continue with its other managerial and developmental activities, (7) develop CALS reference data, (8) develop test procedures, and (9) provide technical advice to Service Lead Test Beds.

Each Service Lead Test Bed will have capability in all the CALS application categories. However, key Service Lead Test Beds will also assume a primary lead responsibility for testing in one application category as follows:

Technical Publications:	Air Force
Engineering Data:	Navy
Support Data:	Army
Data Acceptance Procedures:	Army
Data Protection and Security:	Defense Logistics Agency (DLA)
Data Configuration Management :	OASD/Defense Quality and Standardization Office (DQSO)

2.4.3 Test Reports

The results of each test will be documented in a Preliminary Test Report that is to be made available on Info-X within 30 days of the interchange; a draft of the Final Test Report will be available within 60 days. The Final Test Report will follow and will be made available both on Info-X and on paper. Final Test Reports will be cleared through each participating organization before release. The final report will include:

- A comparison of the transmitted and received documents, noting their respective usability;

- A summary of analyses on the test sets at: the originating (sending) facility, the receiving facility, and, in the case of a CPT, the designated test bed(s);

- A list of problems and areas where changes are recommended to MIL-STD-1840A either for clarification or to resolve technical problems.

If several interchanges involving the same test participants occur within a relatively short period of time, each interchange will be documented in a Preliminary Test Report, but the suite of tests may be summarized in a single Final Test Report. In the case where a draft Final Test Report is made available on Info-X within 30 days of an interchange, the requirement for a Preliminary Test Report will be waived.

2.5 Plans for the Future

In order to meet its objectives, the CTNO must be involved in identifying, promoting, and monitoring changes and additions to existing CALS Standards. It must also be aware of new standards as they emerge and must develop methods for testing these standards.

2.5.1 Changes to Existing Standards

As CALS Standards are incrementally developed and new amendments are released, the CTNO plans will be reviewed and adjusted accordingly. This may involve changes or additions to reference files, test sets, test kits, test procedures, and testing software.

In addition, one objective of the CTN is to help define functional application (application protocol) specifications. These specifications are subsets of the CALS military specifications such as the classes within MIL-D-28000 and the types within MIL-R-28002. The main value of functional application specifications is that applications, such as technical illustrations, which require only a small subset of a full military specification, such as MIL-D-28000, are not forced to develop and maintain expensive, complicated software tools that will not be utilized. Such tools are generators (pre-processors), interpreters (receivers, post-processors), and parser/verifiers. The CTNO technical staff will help define new functional application specifications by identifying needs and subsets while analyzing test data.

2.5.2 Testing of New Standards

The CTNO will monitor progress being made within the application categories of Support Data, Data Protection and Security, and Data Configuration Management. Progress will lead to the establishment of standards that address these categories.

When the new integrated product information model, known as the Product Data Exchange Specification (PDES), is ready, it will be combined with the Integrated Support Data Base (ISDB) to specify the initial Integrated Weapons System Data Base. The CTNO will continue to monitor PDES development and will provide the developers of PDES test procedures with the results of CTN test findings and experience.

The CTNO will also monitor progress in related areas such as Logistics Support Analysis Records, Electronic Digital Interchange (EDI), Electronic (Pageless) Technical Manuals/Orders, Concurrent Engineering (CE), and Total Quality Management (TQM).

New methods of testing must be developed for standards that deal with relational databases, distributed databases, and query languages. The CTNO is currently doing some preliminary thinking and technical planning in this area.

3 User Application Testing

3.1 Overview

This chapter covers the broad topic of CTN testing with emphasis on user application testing. Subsequent chapters describe testing that is specific to application categories.

User application testing refers to testing the performance and usefulness of the standards from a user's point of view. Such testing supports the CTNO overarching goal by ensuring that digital technical information is interchanged under actual use (realistic) conditions and that it is fully functional when it arrives. End users will be involved in this testing to see that usable documents result from the use of the CALS Standards.

The term "distributed" refers to the use of existing sites, wherever they may be, as test participants in CTN. This is done to minimize test facility investments by drawing upon already available resources. Utilization of existing sites also helps to ensure that the requirement for actual use conditions will be met.

Within the goal of testing, evaluating, and demonstrating the CALS Standards under actual use conditions, the objectives of user application testing are to:

- Demonstrate digital data interchange to create confidence and familiarity with CALS Standards;

- Determine the bounds within which the Standards are effective. The testing will determine which data types are effectively transferred and are usable and which are not. Results may lead to recommendations for future areas of expansion to the Standards;

- Identify defects in the Standards and recommend corrections;

- Determine constraints in the use of the Standards. Constraints may reflect technical limitations of the Standards or of the equipment used to process transferred information. When technical limitations are discovered, the CTNO will recommend changes.

3.2 Definitions and Background

3.2.1 End-to-End and Single-Ended Tests

From the point of view of network traversal, there are two general categories of user application tests, end-to-end tests and single-ended tests.

a. End-to-end tests involve the digital transfer of a total product, such as an engineering drawing, from an originating (or storing) facility to a using facility. These tests have the advantages that they: (1) ensure actual use conditions and allow for functional testing of documents or data after they have been transferred, and (2) utilize existing sites (facilities). All end-to-end tests that are CPTs must be scheduled with the CTNO Test Coordinator.

b. Single-ended tests are tests between a single node and a Service Lead Test Bed. They are relatively easy to set up because they require less coordination with test participants. They are useful for checking CTNO and Service Lead Test Bed test software and for doing preliminary data acceptance testing. Single-ended tests will be used in some initial CTN activities, but the main thrust of CTN user application testing will be end-to-end tests. Single-ended tests are to be scheduled with the appropriate Service Lead Test Bed or the CTNO.
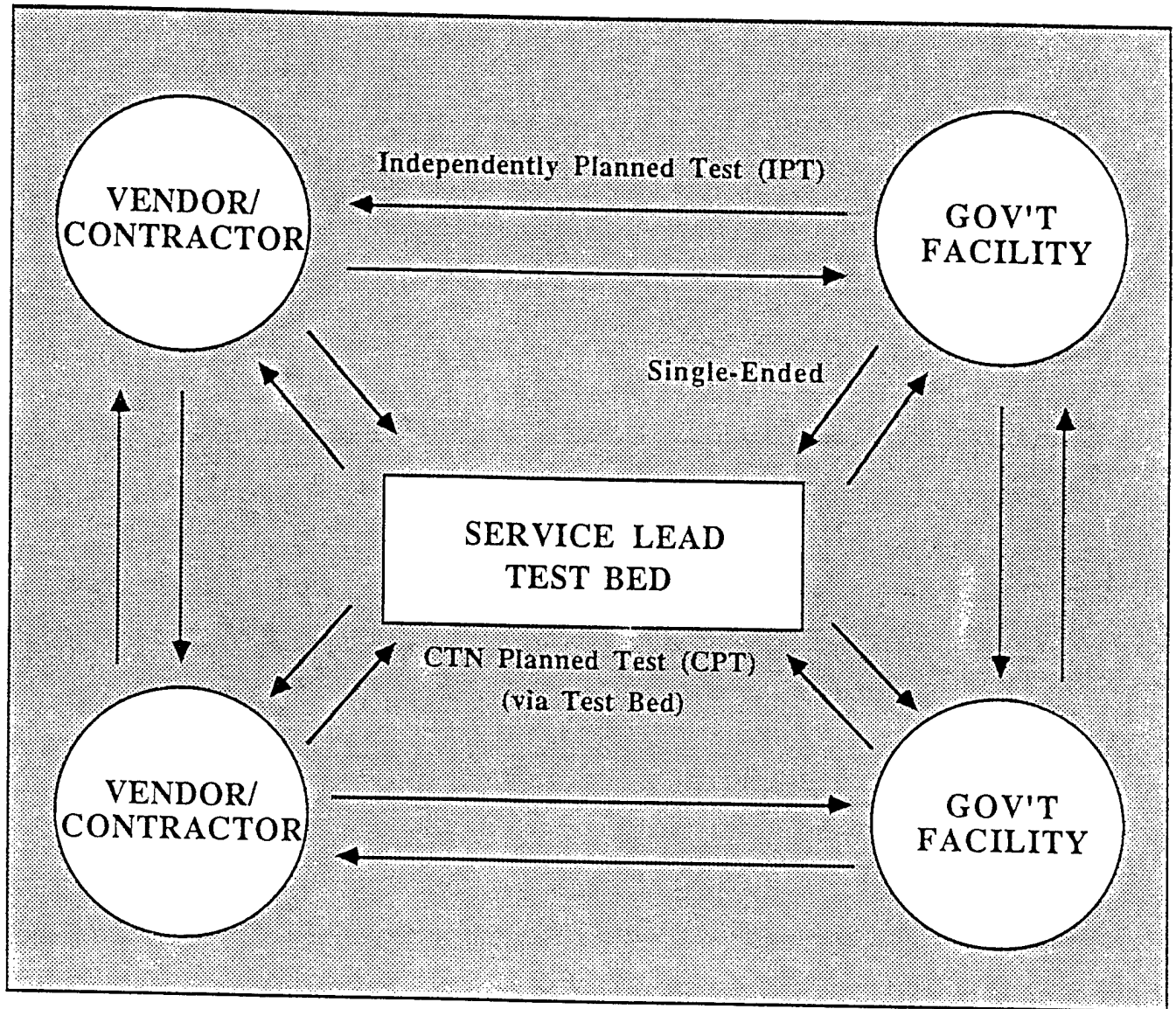
User Application Testing

Figure 4

3.3 Testing Methodology

Each user application test will illustrate the transfer and use of at least one complete, representative document from an important category of sending systems to an important category of receiving systems. The transfers also will illustrate the use of transmission media, such as magnetic tape. Important categories of originating systems include defense contractor technical publications facilities, engineering drawing systems, computer-aided drafting/design systems, or related industry or government repositories for publications or engineering data. Receiving systems are contained in similar categories.

The CTN testing methodology evaluates the complete digital data interchange process involved in the transfer of technical information from an originating facility to a receiving facility. This data interchange process is illustrated in Figure 5. Data is created at the originating facility during component design, development, testing, and manufacture. This information is created in a format consistent with the originating facility's attributes and requires quality assurance/quality control (QA/QC) measures and inspections for technical accuracy and content. When the data is ready for transfer, it is translated by the sending system into a standard format that is acceptable to the receiving facility.

Following data translation, the deliverable is inspected to assess that the digital information conforms to the standard format specified for transfer, and is readable and complete. As part of this digital data QA/QC process, the originating agency's capability (hardware, software and procedures) to translate data into the standard format can be tested through the application of conformance testing.

The transfer process involves the creation of files in standard format on transferable media. Presently the medium specified by MIL-STD-1840A is 9-track magnetic tape.

The process of receiving information in digital form involves the inspection and acceptance of the data as the completion of a deliverable product. This acceptance process determines data completeness and whether the data meets the specified transfer format for compatibility with the receiving facility. The receiving facility may use the data in this standard form or translate it into their native form. The receiving translation process (hardware, software and procedures) can also be tested to determine whether it can receive and translate data that conforms to the Standards.

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Documents to be used in initial user application tests will come from the Technical Publications or Engineering Data application categories. Two types of documents may be found in each set of digital test files (test set):

- CTNO reference documents of precisely known technical content;

- Actual documents being delivered or previously delivered between industry and government sites.

Normally one or more actual documents will be transmitted for each of the application categories. When applicable, one or more reference documents will be transmitted for each of the four data format specifications contained in MIL-STD-1840A.

The general test procedure is also illustrated in Figure 5. Test data in hard form is provided to the originating participant, who is asked to translate this information into a digital format utilizing an appropriate CALS Standard. The hard data could be an engineering drawing, illustration, and/or technical manual. The originating participant is asked to provide the digitized data on a 9-track tape in MIL-STD-1840A format.

In a user application test that is both end-to-end and a CPT, two tapes would be made, one for evaluation by the appropriate CTNO test platform and the other sent to the receiving test participant. Reference data on magnetic tape is also transferred by CTN to the receiving facility. The data on both tapes are translated to the native format utilized at the receiving facility and the results are analyzed by the CTNO technical staff.

During a user application test that is an IPT, actual design and production information is used in the transfer. The intermediate step of tape analysis by the CTNO test platform may or may not be performed depending upon the agreement between the test participants and CTNO.

Each user application test will include these steps:

- Preparation of the MIL-STD-1840A test sets at an originating site;

- Transfer of the test sets to one or more of the test beds for evaluation of adherence to MIL-STD-1840A and for analysis of the data (this step may be omitted for IPTs);

- Transfer of the test sets to the receiving organization for testing of acceptance, processing, and use.

Digital Data Interchange

Creation   Translation   QA/QC   Receipt   Translation   Application

Transfer

Conformance
Testing to Test
Translation Software
Prior to Transfer

Data
Acceptance
Testing

Conformance
Testing to Test
Translation
Software
(optional in
steady state
condition)

Test Inputs

Reference Data
'Real Data'

Test Outputs

Digital Data
Physical
Output
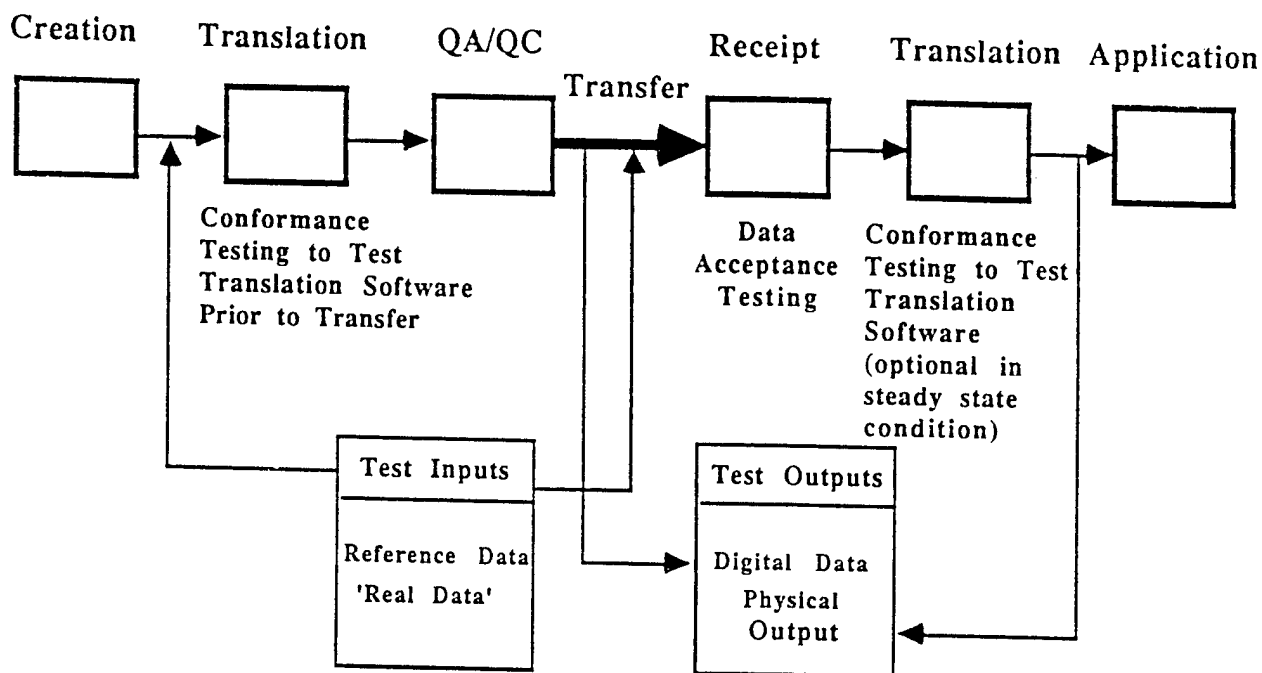
Figure 5

3.4 Implementation of Interchange Testing

This section describes the various combinations of tests (interchanges) that will be implemented among the three categories of test participants. To qualify for interchange testing, each test participant must have a facility that can send and receive test sets in accordance with MIL-STD-1840A.

3.4.1 Industry To Test Bed

As a first step, interchange in the form of CPT single-ended testing will be established between various industry participants and the appropriate Service Lead Test Beds. Utilizing MIL-STD-1840A, industry participants will provide

(and will be provided with) digital interchange data that constitutes the test set. The capability of organizations to both send and receive test sets will be evaluated. Preliminary and Final Test Reports will be generated for each test as detailed in Subsection 2.4.3.

3.4.2 Test Bed To Government Or Industry Facility

The appropriate Service Lead Test Bed will prepare interchange test sets for single-ended testing in accordance with MIL-STD-1840A and submit them for input to government or industry facilities. These interchange tests will be conducted in a controlled environment to maximize effectiveness of the test while minimizing impact on production sites. Government test facilities will be identified in a way that will minimize any disruption from the testing. Test Reports documenting the results will be prepared for each interchange.

3.4.3 Industry Facility To Government Facility

User application digital data interchanges will be conducted both from industry to government facilities and from government to industry facilities. To the maximum extent possible these tests will utilize actual weapon system data. In this way, the receiving facilities will benefit both from what is learned as a result of the test evaluation and from subsequent use of the transferred data. Final Test Reports on these interchanges will document both the transfer of data according to MIL-STD-1840A and the functional use of the data by actual end users at the receiving facility.

3.4.4 Government Facility To Government Facility

User application tests will be conducted between pairs of government facilities. These interchanges will be performed and documented in a manner similar to that described in Subsection 3.4.3.

3.4.5 Industry Facility To Industry Facility

User application tests will be conducted between pairs of industry test participants. These interchanges will be performed and documented in a manner similar to that described in Subsection 3.4.3.

4 Technical Publications Testing

4.1 Overview

The application category "Technical Publications" is defined in Subsection 2.1.1. Testing, evaluating, and demonstrating digital data interchange for Tech Pubs involves testing, evaluating, and demonstrating the pertinent military specifications within MIL-STD-1840A. Currently those military specifications are:

For text:

MIL-M-28001 Types I & II	"Markup requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text " (SGML)

For illustrations:

MIL-D-28000 Class I	"Digital Representation for Communication of Product Data, IGES Application Subsets"
MIL-R-28002 Types I & II	"Raster Graphics Representation in Binary Format, Requirements for"
MIL-D-28003	"Digital Representation for Communication of Illustration Data: CGM Application Profile"

See Appendix C for more details about the individual specifications.

The other aspects of MIL-STD-1840A that will require testing for Tech Pubs are the tape formatting specifications (the digital envelope) and the tape packaging specifications (for mailing) in the standard itself.

4.2 Implementation

Detailed individual tests will be planned by Service Lead Test Beds for all CTN planned user application tests.

4.2.1 Reference Test Set

A test set of known technical content (reference test set) has been constructed. In addition to testing the digital envelope, this set will be used to test the technical content of both the text (including tables) and illustration data. The initial reference test set contains SGML-tagged text; subsequently it will be expanded to include IGES, Raster, and CGM data. With the reference test set will be documentation detailing the contents of the set and procedures on how to use it.

4.2.2 Data Transfer Tool Kit (Prototype)

One objective of MIL-STD-1840A is to provide a means for transferring large amounts of Technical Publications information, not just one or two small test documents. In terms of magnetic tape, we define a "large volume" transfer as one that requires multiple reels of tape. The transfer could consist of a single, lengthy document or of many smaller documents associated with a particular weapon system or subsystem. The process of transferring the multiple reels as a consistent set will be demonstrated and tested.

In order to handle data transfers of Tech Pubs data, operations personnel at both the sending and receiving facilities will require software tools that make the preparation and receipt of the test sets as automated as possible. This software "tool kit" is being built and documented by the CTNO technical operations staff at LLNL. It will not be as fully developed as a software production tool, but in prototype form it will: (1) be useful for large volume transfer tests, (2) provide useful information for the development of production transfer tools, and (3) be available to all government agencies and CTN members.

The prototype data transfer tool kit will consist of two categories of tools: preparation tools and quality assurance tools. The preparation tools will be used only by personnel at the sending facility, while the QA tools will be used at both the sending and receiving facilities. Documentation will also be provided that contains a step-by-step procedure on how to use the tool kit to generate MIL-STD-1840A compatible magnetic tapes.

4.2.3 Large Volume User Application Tests

When the prototype tool kit (Subsection 4.2.2) is available to participating organizations, large volume transfer tests will begin. These tests will provide demonstration and testing of MIL-STD-1840A by showing the automated interchange of technical information in large volume. These tests will be used for concurrent evaluation of both MIL-STD-1840A and the tool kit.

The large volume tests will be based on file sets from at least six different sources. The greater the number of sources, the greater the assurance that the test results are representative.

The principle tasks will be to install the prototype tool kit, implement required changes to it, train selected sending facility personnel in its use, and transfer large volume test sets. Results will be documented with special attention to improvements needed in MIL-STD-1840A; testing will also improve the tool kit.

5 Engineering Data Testing

5.1 Overview

The application category "Engineering Data" is defined in Subsection 2.1.1. Testing, evaluating, and demonstrating digital interchange for Engineering Data involves testing, evaluating, and demonstrating the pertinent military specifications within MIL-STD-1840A. Currently those specifications are:

For engineering drawings:

MIL-D-28000, Class II — "Digital Representation for Communication of Product Data, IGES Application Subsets"

MIL-R-28002, Types I & II — "Raster Graphics Representation in Binary Format, Requirements for"

See Appendix C for more details about the individual specifications.

MIL-D-28000 data for Classes III, IV, and V (electrical, NC, and 3D piping & tubing) will be addressed by CTN in the future.

Other aspects of MIL-STD-1840A that will require testing for Engineering Data are the tape formatting specifications (the digital envelope) and the tape packaging specifications (for mailing) in the standard itself.

5.2 Implementation

Detailed individual tests will be planned by Service Lead Test Beds for all CTN planned user application testing.

5.2.1 Analysis Tools

As a first step in implementing testing of the Engineering Data application category, CTNO will acquire and evaluate (or develop) the necessary analysis tools. A complete Engineering Data tool kit will consist of tools to analyze data according to the two supporting specifications (IGES and Raster) and the MIL-STD-1840A digital envelope. Also, a checklist will be developed to compare tapes received in the mail against the tape packaging specifications.

CTNO analysis tools exist for all published classes of MIL-D-28000 data. Tools have been developed for Raster Type I. Tools for Raster Type II will be developed in the future. Some of these analysis tools are publicly available; others are available only through private sources. For more information contact the CTNO at Wright-Patterson AFB or at Lawrence Livermore National Laboratory (see Appendix E).

5.2.2 Reference Test Set

An adjunct to obtaining the analysis tools will be developing reference test sets for each of the subcategories within Engineering Data. These test sets will be used for analytical evaluation of the standards along with preliminary conformance and acceptance testing. The test sets will also be used for testing the analysis tools. As with the analysis tools, a complete set of Engineering Data reference test sets will consist of those for the two supporting specifications (IGES and Raster) with their accompanying digital envelopes. These reference data sets are available to CTN members upon request.

5.2.3 Single-Ended Testing

The next step is to perform single-ended tests at the Service Lead Test Beds for the purpose of debugging the analysis tools and the reference test sets. Some testing has been done for MIL-D-28000 Class II. Testing is planned for MIL-D-28000 Class I, is under way for MIL-R-28002 Type I, and will be done in the future for MIL-R-28002 Type II.

As the CALS Standards evolve, the analysis tools and reference test sets will be updated. Every change, correction, or addition to the tools or sets may require additional single-ended testing.

5.2.4 Large Volume User Application Tests

As in the case with Technical Publications, a significant test of Engineering Data will be to transfer large volumes, not just a few drawings or models. Tools to help prepare and process hundreds of engineering drawings will be developed and tested on actual data, both in CPTs and IPTs. Again, the tools must handle both IGES and Raster formatted data. This type of testing would be the core of the user application testing.

APPENDIX A

Test Participant List

This represents known capability at the time of publication. For current data, contact the CTNO or the appropriate Service Lead Test Bed.

Check marks indicate interest and/or capability. See comments.

A.1 Service Lead Test Beds

	Tech Pubs				Engr Data		Capabilities/Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
AIR FORCE							- 1840A: tape evaluation - IGES: processing, viewing, plotting - SGML: processing, editing, printing - Raster: analysis & plotting* - CGM: processing & plotting - Media: magnetic tape, optical disk, & network (DDN)*
HQ AFLC LMSC/SJT WPAFB, OH	√	√	√		√	√	
LLNL Livermore, CA	√	√	√	√	√	√	- 1840A: tape evaluation - IGES: analysis & plotting - SGML: analysis & processing - Raster: analysis & processing* - CGM: processing & plotting - Media: magnetic tape & network (DDN, TYMNET, T1, Ethernet)*
ARMY							- 1840A: tape evaluation (also evaluation of floppy disk, optical disk, & DDN data in 1840A-like format*) - IGES: viewing, analysis, editing & plotting - SGML: analysis & processing - LSAR: full SQL query capabilities - Media: magnetic tape, optical disk, & network (DDN, T1)
Army PM CALS Fort Monmouth, NJ	√	√	√	√	√	√	

A.1 Service Lead Test Beds (Cont.)

	Tech Pubs				Engr Data		Capabilities/Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
NAVY David Taylor Research Center (DTRC) Bethesda, MD	√	√	√	√	√	√	- 1840A: tape evaluation - IGES: analysis & plotting - SGML: processing, editing, & DTD analysis - Raster: analysis & processing - CGM: to be determined - PDES: modeling - Media: magnetic tape & network (DDN)*
DLA To be determined							- Capabilities to be determined

* Hardware and some software are in place, but CALS Standards have not yet been established for interchange via floppy disks, optical disks, nor telecommunications.

A.2 Government Test Participants

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
AIR FORCE							
ATOS/AFTOMS	√	√	√	√			- Proposed test-DTD development
EDCARS (DSREDS)					√	√	- Proposed joint test with Army;
WR-ALC, Robins AFB	√	√			√		- Ongoing tests-Technical Order & Engineering Data
SM-ALC, McClellan AFB							
OO-ALC, Hill AFB					√		- Proposed test-Engineering data
OC-ALC, Tinker AFB							- Proposed test-Engineering data
SA-ALC, Kelly AFB	√	√					- Plan to participate in ongoing test-Technical Order
Aeronautical Systems Div Wright-Patterson AFB					√		- Completed test-Engineering data
ITDS Program Office	√			√			- Proposed test-Technical Order
Tactical Engines Prgm Office	√	√					- Ongoing test-Technical Order
ARMY							
Army Armament, Munitions & Chemical Command	√	√	√	√			- Proposed test-Technical Publication
DSREDS (EDCARS)					√	√	- Proposed joint test with Air Force
NAVY							
Naval Aviation Depot	√		√		√		
Naval Ocean Systems Ctr		√			√		
Naval Sea Combat Sys Engineering Station		√			√		- Completed test-Engineering Data
Naval Sea Systems Command		√			√		- Proposed test-Engineering Data
Naval Undersea Warfare Engineering Station					√		

A.2 Government Test Participants (Cont.)

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
OTHER							
Department of Transportation					√	√	
DOE/LLNL Technical Information Dept							
Georgia Institute of Technology	√	√			√		- Ongoing test; preparing a plan for research and development of a CALS educational program; planning to be a test node.
Government Printing Office							
National Institute of Standards & Technlgy, IGES and PDES		√			√		- Proposed test-PDES; PDES test platform; leads development of IGES, PDES, and CALS Standards;
South Carolina Rsrch Authority		√			√		- Manages PDES, Inc.; Navy RAMP
USC Information Sciences Institute			√	√			

A.3 Industry Test Participants

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
Access Corporation			√				
Applied Info Technlgs Research Center	√						
AT&T Federal Systems	√	√	√	√	√	√	
AUDRE	√	√	√	√	√	√	
Auto-Trol Technology		√	√	√	√	√	
Avalanche Development	√						
AZTEK				√			
Boeing Computer Srvcs		√	√				
Boeing Military Airplane		√			√		- Completed test with Air Force-Tech Pub
Cadkey, Inc.					√		
Casterline Comptr Cnslt			√				
CERC		√					
CIMLINC, Inc.	√						
Compugraphic	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
Concept Development Technologies	√	√	√	√	√	√	
Context	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
C-TAD Systems		√			√		
Daisy/Cadnetix, Inc.				√	√		
Datalogics, Inc.	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
Douglas Aircraft Co.	√	√	√	√	√	√	- Completed test with CTNO-Engr Data
Electronic Data Systems							
Exoterica	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
Ford Aerospace	√	√			√		
Frame Technology	√		√	√			
General Dynamics Data Systems	√	√	√		√	√	
General Dynamics Electric Boat	√	√	√	√	√	√	

A.3 Industry Test Participants (Cont.)

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
General Dynamics, Ft. Worth	√	√	√	√	√	√	
GE Aircraft Engines					√		
GE Corporate Engring	√	√	√	√	√	√	
Grumman Aerospace Corp	√						
Grumman Data Systems	√	√	√	√	√	√	
GSC Associates Inc			√	√		√	
GTE	√	√	√	√	√	√	
GTX				√	√	√	
Harris Corporation	√	√	√	√	√	√	
Hewlett Packard					√		
Honeywell Military Avionics Division	√	√			√		- Completed test with Air Force-Tech Pub
Honeywell Ordinance Div					√		
Hughes Aircraft		√			√		
IBM	√	√	√	√	√		- Completed test with CTNO & Industry Participants-Tech Pub
IDEAL Scanners Inc						√	
IGES Data Analysis		√					
InterCAP Graphics Sys		√	√	√			
Intergraph	√	√	√	√	√	√	
Interleaf	√	√	√	√			- Completed tests with CTNO & Industry Participants-Tech Pubs
International TechneGroup		√					
J.D. Kiser & Associates	√	√	√	√	√	√	
Knowledge Base Int'l							- Newsletter-"CALS Report"
Kruse Industries					√	√	
Litton Computer Services	√	√	√	√	√	√	
Lockheed Georgia	√	√			√		- Completed test with Air Force-Tech Pub; Ongoing test with Air Force, Georgia Tech & CTNO-Tech Pub
Lockheed Missiles & Space							
McAir Telecommunications							
McDonnell Aircraft Co.	√	√	√	√	√	√	- Completed test with Air Force, CTNO & Industry Participants-Tech Pub
McDonnell Helicopter Co	√	√	√	√	√	√	

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
Martin Marietta Data Sys	√	√	√	√	√	√	
Martin Marietta Electronics & Missiles Group		√			√		
Meridian Data Inc							
Minigraph			√			√	
MITRE							
Motorola	√	√	√	√	√		
Newport News Shipbldg				√	√		
Northrop Corporation	√	√		√			- Ongoing test with CTNO & Industry Participants-Tech Pub
Pratt & Whitney	√	√					- Completed tests with Air Force, CTNO & Industry Participants-Tech Pubs; Ongoing test with CTNO & Industry Participants-Tech Pub
Rockwell International	√		√				- Completed test with Air Force-Tech Pub
Scribe Systems, Inc	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
Smiths Industries	√	√	√	√	√	√	
Softquad, Inc.	√	√	√	√			- Completed test with CTNO & Industry Participants-Tech Pub
STS Information Service	√		√		√		
Sun Microsystems	√						
Swedish Institute of Production Engr Rsrch					√		
Sydney Communications Ltd.	√	√					
Syscon	√	√	√	√			
Texas Instruments	√	√	√	√	√	√	
TRW	√	√	√	√	√	√	
United States Video Corp			√		√	√	
Vitro Corporation	√	√		√		√	- Completed test with CTNO & Industry Participants-Tech Pub
Volt Group	√						
Wang	√	√	√	√	√	√	- Participated in NCGA '89 demo

A.3 Industry Test Participants (Cont.)

	Tech Pubs				Engr Data		Comments
	SGML	IGES	Raster	CGM	IGES	Raster	
WESCO			√			√	
Williams International	√		√		√		
Wiz Worx					√		
Xerox Special Info Sys	√	√	√	√	√	√	
Xyvision, Inc.	√	√	√	√			- Completed test with Air Force, CTNO & Industry Participants-Tech Pub

APPENDIX B

Format of Draft Test Plan Document

1. Introduction and Background

This section contains information that describes the circumstances that identified the requirement for this proposed CTN test. It provides the background that qualifies the participant's ability and desire to conduct this CTN test. It will contain, if applicable, the participant's previous experience and capabilities in CALS and/or in digital technical data. The participant's membership on any applicable industry/government committees (such as CALS, AIA, NSIA, NCGA, GCA, etc) will be listed. The type of user application test (end-to-end or single-ended) and whether IPT or CPT will also be shown.

2. Objective

This section details the stated objectives of the CTN test, including which technical areas of CALS digital data will be tested and the expected benefits.

3. Standards and Specifications

This section identifies the CALS standards and specifications that will be tested and/or utilized in this CTN test.

4. Procedures

This section contains the general and detailed procedures that will be utilized in this proposed CTN test. The procedures for the generation and delivery of test items and how they will be tested and evaluated will be included in this section.

5. Facilities and Equipment

This section lists the facilities, hardware, and software that will be utilized by the participants. Included will be the software tools (commercially available, public domain, or in-house produced) that will be used in the testing. Hardware and software will be identified by name, model, and version number, including applicable specifications.

6. Deliverables

This section identifies the CTN test reports that will be written, and will identify each participant's role in their review, approval, and publication.

7. Schedule

This section contains the detailed production and delivery schedule, and the schedule for the preparation of the CTN test reports.

Annex 1: Participants

This annex lists all of the industry, government, DoD, and CTN participants involved in the CTN test, their point(s) of contact, their addresses and their phone/FAX numbers, along with their role in the testing.

APPENDIX C

Overview of MIL-STD-1840A Standard and Specifications

C.1 MIL-STD-1840A

MIL-STD-1840A, "Automated Interchange of Technical Information," standardizes the digital interface between organizations or systems exchanging digital forms of technical information necessary for the logistic support of weapon systems throughout their life cycle. It addresses computer automated creation, storage, retrieval, and delivery of data in the areas of technical manuals and engineering drawings. However, it does not yet exploit the full potential of emerging computer-based technologies such as solid modeling, interactive retrieval, and expert systems.

In particular, MIL-STD-1840A standardizes the format and information structures of digital data files used for the transfer and archival storage of digital technical information. It currently recognizes two types of media for digital exchange: magnetic tape, and optical disk. However, it standardizes only magnetic tape transfers at this time.

C.2 MIL-D-28000 (IGES)

MIL-D-28000, "Digital Representation for Communication of Product Data: IGES Application Subsets," defines subsets of the Initial Graphics Exchange Specification (IGES) for various classes of data, listed below.

IGES is a neutral format for digital interchange of Product Definition Data (PDD) between dissimilar computer-aided design (CAD) systems.

The classes (unambiguous subsets of IGES entities) specified by MIL-D-28000 are:

Class I - "Technical Illustrations." This is 2D vector data contained in illustrations designed for human interpretation.

Class II - "Engineering Drawings." This is 2D and 3D vector data such as that found in CAD models and CAD Drawings.

Class III - "Electrical/Electronic Applications." This is product data for printed wiring boards, printed wiring assemblies, hybrid micro-assemblies, flexible printed wiring harnesses, cables, and conventional wiring harnesses.

Class IV - "Geometry for NC Manufacturing." This is data designed to support the geometry data needs of process planning and numerical control (NC) cutter path generation.

Class V - "3D Piping and Tubing."

IGES is the most widely recognized format currently available for moving digital data from one CAD system to another. An IGES file may be used to create a CAD database in a receiving CAD system. The IGES file represents the information content of a private, proprietary CAD database in a public, non-proprietary form.

C.3 MIL-M-28001 (SGML)

MIL-M-28001, "Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text," defines standard DoD requirements for all of the steps involved in automated publishing of page oriented (i.e., printed) technical publications. For exchange of source data (prior to document composition) it defines a common implementation of the Standard Generalized Markup Language (SGML). For composition processing functions, it will define an Output Specification (OS) of typographic page and format rules; for display of the composed document, it provides options for use of commercial Page Description Languages (PDLs).

MIL-M-28001 contains rules for tagging technical manuals according to the Document Type Definition (DTD) MIL-M-38784A/B. A DTD provides guidance on the superstructure of information components (e.g., titles, subtitles, and paragraphs) within a document. New DTDs will be added to MIL-M-28001 for such documents as organizational maintenance manuals, flight manuals, and output specifications.

Two types of data files currently satisfy the requirements of MIL-M-28001:

Type I - Technical manuals that conform to MIL-M-38784.

Type II - Technical manuals conforming to other military specifications.

C.4 MIL-R-28002 (Raster)

MIL-R-28002, "Raster Graphics Representation in Binary Format, Requirements for," defines the format and structure required to support raster data interchange. Specifically, it defines DoD technical requirements for raster (bitmap) graphics that have been compressed to reduce file size and transmission time. CALS must apply raster graphics to both office documents and facsimiles (for which the international standard that MIL-R-28002 implements was prepared), and for engineering drawings and other oversize documents. An option is included to use tiling, in which the raster image is divided into a series of tiles that can be individually processed to reduce throughput and terminal storage requirements.

MIL-R-28002 identifies two types of raster data:

Type I - "Untiled Raster Graphics Data." This is single-page raster data such as that found in digitized images and digitized engineering drawings.

Type II - "Tiled Raster Graphics Data." Raster data that can be abutted or tiled.

C.5 MIL-D-28003 (CGM)

MIL-D-28003, "Digital Representation for Communication of Illustration Data: CGM Application Profile," specifies the use of Computer Graphics Metafile (CGM) for the transfer of 2D illustrations for use in Technical Publications. CGM, as specified in ISO 8632, is a graphics transfer standard that is becoming widely accepted, with some CAD vendors already supporting it. CGM files are generated and interpreted through translators similar to IGES. While IGES files contain model and product definition data required to support the CAD/CAM analysis of a file, CGM files contain only 2D picture or image data. Consequently the CGM standard file format is easier to interpret and the file size is much more compact than IGES.

APPENDIX D

Actions and Dates for CALS Testing

What is to be Tested	Estimated Completion *
Technical Publication Segment 1: SGML & 1st Set of DTDs & Illustrations	3rd Qtr FY-90
Technical Publication Segment 2: Output Spec. & 2nd Set of DTDs & Illustrations	1st Qtr FY-91
Technical Publication Segment 3: CGM	2nd Qtr FY-91
Engineering Drawing Segment 1: IGES I, II	2nd Qtr FY-90
Engineering Drawing Segment 2: IGES III, IV	2nd Qtr FY-91
Engineering Drawing Segment 3: IGES V, VI	TBD
Engineering Drawing Segment 3: RASTER, No Tiling	3rd Qtr FY-90
Engineering Drawing Segment 4: RASTER, Tiling	2nd Qtr FY-90
LSA/LSAR, SQL & Relational Data Base	2nd Qtr FY-91
LSA/LSAR, Advanced SQL	4th Qtr FY-92
Data Protection & Security	TBD
Data Configuration Management	TBD
Data Acceptance Procedures	TBD

* At this date, the CTNO estimates a 95% confidence that 80% of the problems with the standard itself will have been found and corrected. This is not to imply that all products associated with the standard have achieved this same level of accuracy.

APPENDIX E

CTNO Organization Roster

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Melvin S. Lammers	CTNO Director
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C. Michael Christie	Navy Coordinator
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Donald L. Vickers	Deputy CTNO Technical Operations Manager & Tech Pubs Lead Analyst
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APPENDIX F

References

CTN REPORTS *

Number	Title	Sponsor	Issue Date
88-002	CTN Strategic Test Plan	CTNO	7-15-88
89-001	The CALS Test Network MIL-D-28000 Class II Reference Drawing Packet Revision C	CTNO	1-27-89
89-003	CTN Test Plans	CTNO	5-15-89
89-004	CTN Testing Philosophy	CTNO	3-24-89
89-005	DSREDS/EDCARS MIL-STD-1840A Review	CTNO	8-15-89
89-006	CTN Membership Application/Memorandum of Agreement	CTNO	1-27-89
89-007	CTN Information Exchange Users' Manual	CTNO	6-12-89
89-008	CTN Strategic Plan	CNTO	10-11-89
89-009	CTN Flier	CTNO	4-13-89

CTN TEST REPORTS *

Number	Title	Sponsor	Issue Date
87-001	Comparison of CCITT Group 4 Compression with Wrap-Around and Standard CCITT Group 4 Compression	CTNO	6-08-87
87-002	Pratt and Whitney Technical Order Transfer Tests	AF	6-12-87
87-003	Honeywell Technical Order Transfer Tests	AF	6-12-87
87-004	Rockwell NAAO Technical Order Transfer Tests	AF	6-12-87
87-005	Boeing Military Airplane Co. Technical Order Transfer Tests	AF	6-12-87
88-001	Lockheed Aeronautical Systems Co. Technical Order Transfer Test	AF	12-15-88
89-002	Engineering Drawing Transfer Test With Douglas Aircraft Co. MIL-D-28000 Class II (IGES)	CTNO	5-02-89
89-010	Publishing Systems Structured Test No.1	CTNO	to be released
89-011	An Evaluation of an 1840A Magnetic Tape from Interleaf Inc.	CTNO	8-10-89
89-012	Implementation of CCITT Group 4 and Wraparound Raster Compression and Decompression	CTNO	to be released
89-013	Publishing Systems Structured Test No. 1, Summary Report	CTNO	8-10-89
89-014	Engineering Drawing Transfer Test Between Tracor and NAVSEACOMBATSYSENGSTA: MIL-D-28000 Class II (IGES)	CTNO	to be released

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MILITARY STANDARDS **

Title	Issue Date
MIL-STD-1840A with Change Notice 1 (Automated Interchange of Technical Information)	12-20-88
MIL-D-28000 Amendment 1 (Digital Representation for Communication of Product Data: IGES Application Subsets)	12-20-88
MIL-M-28001 (SGML) Part I & II (Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text)	2-26-88
MIL-R-28002 (Raster Graphics Representation in Binary Format, Requirements for)	12-20-88
MIL-D-28003 (Digital Representation for Communication of Illustration Data: CGM Application Profile)	12-20-88
MIL-HDBK-59 (Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program Implementation Guide)	12-20-88

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APPENDIX G

Acronyms

1840A	MIL-STD-1840A
2D	Two Dimensional
3D	Three Dimensional
28000	MIL-D-28000
28001	MIL-M-28001
28002	MIL-R-28002
28003	MIL-D-28003
AF	Air Force
AFB	Air Force Base
AFLC	Air Force Logistics Command
AFTOMS	Air Force Technical Order Management System
AIA	Aerospace Industries Association
AITI	Automated Interchange of Technical Information
ALC	Air Logistics Command
AT&T	American Telephone and Telegraph
ATOS	Automated Technical Order System
CAD	Computer-Aided Design
CALS	Computer-aided Acquisition and Logistic Support
CAM	Computer-Aided Manufacturing
CCITT	International Consultative Committee on Telegraphy and Telephony
CE	Concurrent Engineering
CGM	Computer Graphics Metafile
CPT	CTN Planned Test
CTN	CALS Test Network
CTNO	CALS Test Network Office
CTNRB	CALS Test Network Review Board
DDN	Defense Data Network
DLA	Defense Logistics Agency
DoD	Department of Defense
DOE	Department of Energy
DQSO	Defense Quality and Standardization Office
DSREDS	Digital Storage and Retrieval Engineering Data System
DTD	Document Type Definition
DTRC	David Taylor Research Center
EDCARS	Engineering Data Computer-Assisted Retrieval System
EDI	Electronic Digital Interchange
EIA	Electronics Industries Association
EDMICS	Engineering Data Management Information and Control System
FAX	Facsimile
FOC	Full Operating Capability
FP	Financial Plan
FY	Fiscal Year
GCA	Graphic Communications Association
GE	General Electric
HQ	Headquarters
IBM	International Business Machines

IGES	Initial Graphics Exchange Specification
Info-X	Information Exchange (CTN's Electronic Bulletin Board)
IOC	Initial Operating Capability
IPT	Independently Planned Test
ISDB	Integrated Support Data Base
ISO	International Organization for Standardization
ITDS	Improved Technical Data System
IWSDB	Integrated Weapon System Data Base (CALS Phase II)
LLNL	Lawrence Livermore National Laboratory
LMSC/SJT	Logistics Management Systems Center, Technology Support Office
LSA	Logistics Support Analysis
LSAR	Logistics Support Analysis Record
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MOA	Memorandum of Agreement
NAAO	North American Air Operations
NC	Numerical Control
NCGA	National Computer Graphics Association
NIST	National Institute of Standards and Technology (formerly National Bureau of Standards)
NSIA	National Security Industrial Association
OASD	Office of the Assistant Secretary of Defense
OC-ALC	Oklahoma City - Air Logistic Center
OO-ALC	Ogden - Air Logistics Center
OS	Output Specification
OSD	Office of the Secretary of Defense
OTP	Outline Test Plan
PDD	Product Definition Data
PDES	Product Data Exchange Specification
PDL	Page Description Language
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
RAMP	Rapid Acquisition of Manufactured Parts
SA-ALC	San Antonio - Air Logistics Center
SLTB	Service Lead Test Bed
SM-ALC	Sacramento - Air Logistics Center
SGML	Standard Generalized Markup Language
SP	Strategic Plan
SPFYA	Strategic Plan Fiscal Year Annex
SQL	Structured Query Language
TBD	To Be Determined
Tech Pubs	Technical Publications
TQM	Total Quality Management
USC	University of Southern California
WPAFB	Wright-Patterson Air Force Base
WR-ALC	Warner Robins - Air Logistics Center